FLIGHT

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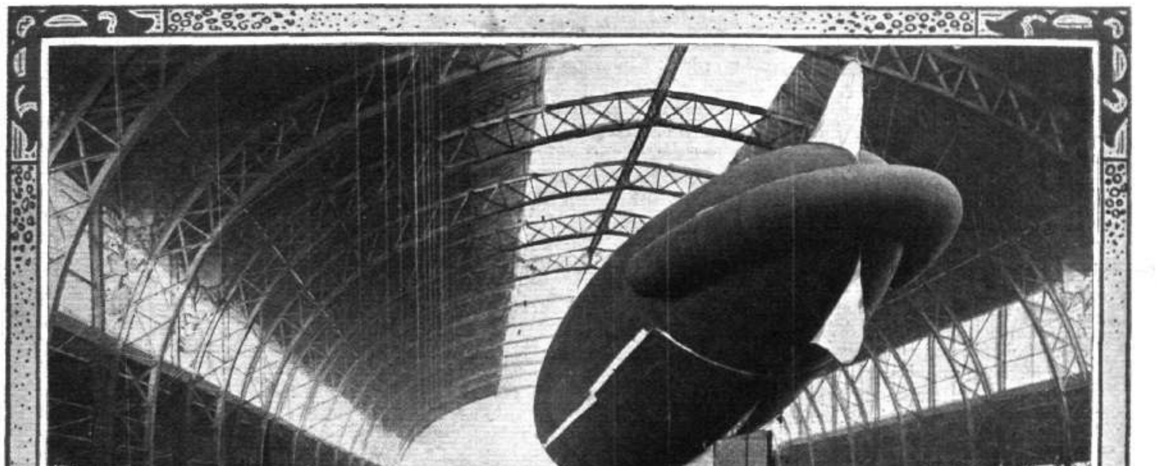


BRUSSELS AUTO AND FLIGHT EXHIBITION.—General view of the main hall taken from the aviation section of the building. the cars being seen at the further half of the hall. The dirigible suspended from the roof is the "Belgica." This is equipped with wireless telegraphy, and the staircase seen in the centre of the building leads up to a platform from which visitors can examine this and the aeronaut's car and the motor. The monoplane seen immediately in the foreground is the "Goffaux" machine.

THE GAME OF "GRAB" IN FRANCE.

LAST week we briefly referred in this column to the necessity which had arisen for the Aero Club of the United Kingdom to take a very firm stand over in Paris at a meeting of the International Federation, and mentioned that it was only by being able to do so that a couple of suitable dates had been set aside for Great Britain upon which to hold aeronautic meetings of a truly great character during the present year. Since then, however, the moral that we then pointed has been emphasised, while apart from that a far from edifying state of affairs has been shown to be in evidence as regards the conduct of aeronautic affairs in France. There is, in fact, at the moment, an open breach that threatens the proposed July meeting over here, and owing to the existence of a very unfortunate game of "grab" on the part of our neighbours across the Channel, a still firmer attitude may yet have to be adopted by this country in order to hold its own.

Briefly stating the position in France at the moment —and writing, of course, quite unofficially—a very hard and fast line must be drawn between the intentions and the ambitions of the Aero Club of France, who *alone* represent that country on the International Federation, and the Commission Aerienne Mixte, which is a purely national body, of which the Aero Club of France is but one unit out of several, and the existence of which is primarily due to an unlovely attempt on the part of the Automobile Club of France to have a finger in controlling the destinies of French aviation. Coupled with this it is pretty clear that the C.A.M. are determined to rule the situation in France, even on International matters, and to override the Aero Club, or to make mischief in the attempt. During the past week, in fact, this precious body has solemnly met and passed resolutions concerning International affairs, which reverse the decision of the F.A.I., and by which the July meeting allotted to Great Britain has been impudently declared cancelled by this interfering body.

Perhaps the most ludicrous part of this French affair is that the C.A.M. are evidently fighting a battle for a large number of would-be promoters, whom it is indeed hard to believe are swayed by philanthropic motives only. And yet it will be remembered that this selfsame C.A.M. was the body which lately passed hard and fast resolutions with regard to future aeronautic meetings rendering it impossible for any individual to gain pecuniary benefit from them, and rendered it incumbent upon all who were granted permits to make a full return of accounts showing that all moneys received had been used for the advancement of the common cause. But the state of affairs in France just as the moment is well calculated to afford an object-lesson to those of our fellow countrymen who might feel inclined to be led away to support rival representative bodies at home. Apart from this, the fact that has immediately to be faced is that already the Frenchman is apparently beginning to show, as he did in connection with the automobile industry, that he can readily acquire what is vulgarly known as a "swelled head" immediately success attends the endeavours of his talented inventors, and that worse than this, commercialism in France is quite devoid of any decent feelings concerning "playing the game fairly and squarely."

Bearing in mind these proclivities, our readers should be on their guard, since it is bound largely to rest with them as to how far this country can checkmate the unfair tactics that threaten from across the water. We have to remember that even the Automobile Club of France, with its high-falutin claims to aristocratic membership and to freedom from the trammels of trade, has long ago lost all such prestige as it might have earned if it had lived up to its fine pretensions. Again, we cannot forget the utterly unfair way in which the French supported motor car racing just (but only) so long as they were able to win each and every race, for these are but a few of the detailed tricks whereby they deferred British supremacy as regards the British markets in the manufacture of automobiles up until the year that has just gone by, when the absence of an automobile salon in France, and the exceptional success of our own exhibition at Olympia, at length broke the power so cunningly maintained.

The point that we have to emphasise now is that on this question of the big meetings of this year the leading spirits in France must be made clearly to understand that they cannot both "have their cake and eat it," in the sense of playing fast and loose with this country when our rights of membership in the International Federation come up for settlement, and at the same time of endeavouring to secure and retain the British public as its best prospective customers for the productions of its manufacturers. If, as is now threatened by the C.A.M., the endeavour is made to prevent French aviators and French machines from taking part in the big British meetings of the year, an equally effective boycott must be established on behalf of this country, and the French industry must be made to smart sufficiently under the ban to induce them to shake off the yoke of their hangers-on and their speculators, who are endeavouring to pull the International strings for their own personal benefit at the moment. Everyone taking an interest in the movement over here can assist very materially, if they will, in checkmating these French tactics, and in securing fair play in International aeronautic politics in future. By strengthening the hands of the British parent bodies—particularly of the Aero Club, which represents this country on the International Federation—those bodies in turn will be able to stiffen the back of the Aero Club of France, and enable it to resist the unwelcome attentions of its overbearing partners in the C.A.M., while in any case it is to the benefit of this country that our own institutions should be in the strongest possible position during the coming year to encourage home productions, home development, and home demonstration—thus to prove in the most practical of all practical manners to the Frenchman that he has not got an altogether complacent and sleepy set of rivals to deal with across "La Manche."

In conclusion, if further proof were needed at the moment to bring home the type of action that is apparently deemed good enough for "Angleterre" in Paris, it is almost comical to observe the "heads-I-win-tails-you-lose" manner in which quite recently Henry Farman is one day acclaimed British when it happens to suit the French string-pullers to set him aside, and is yet acclaimed to be a Frenchman when there is any means whereby France can derive some advantage from his alleged citizenship. But such seems to be the prevalent French idea of "cricket."

FLIGHT PIONEERS.

M. LOUIS PAULHAN.

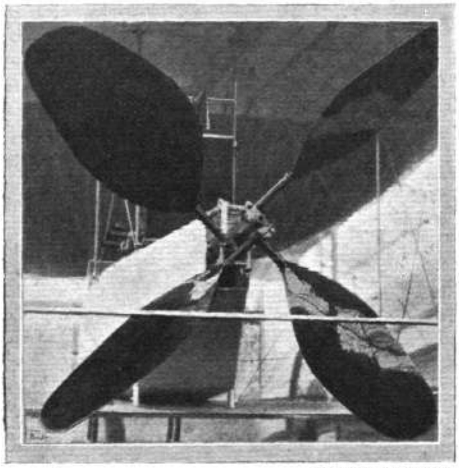
AERIAL PROPELLERS.

AND SOME POINTS WHICH MAKE THEM INTERESTING.

(*Concluded from page* 37.)

The Direct Drive.

DECIDING in advance to use a direct-driven propeller, therefore, may very well prejudice the chance of evolving an efficient design, for the petrol motor is essentially a high-speed engine, and one, moreover, which has but a limited useful range. From the constructional point of view, the direct-drive is a highly convenient method of mounting a propeller, and the mechanical efficiency of its transmission is, of course, at a maximum. But, according to Mr. Lanchester,* the propellers on the Voisin flyers, which employ the direct-drive, are about 15 per cent. less efficient, as propellers, than those on the Wright flyer, which are driven by chains, so that although the relative mechanical efficiency would tend to reduce this difference, the net result would once more be a compromise. On the Howard Wright biplane there are two propellers in tandem on the crank-shaft axis. They revolve in opposite directions at a reduced speed by means of a differential gear.



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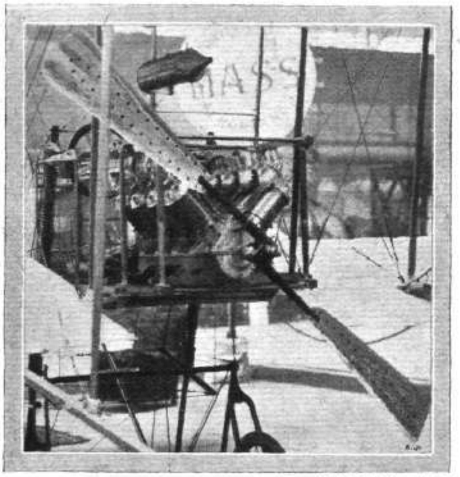
Although apparently a single four-bladed propeller, the mechanism illustrated above, which is a photograph of the Howard Wright machine, consists of a pair of two-bladed propellers which revolve in opposite directions. The blades nearest the engine are larger than the others, and do two-thirds of the work.

Many Blades *v.* Few.

It will be noticed that in none of the foregoing deductions has any account been taken of the number of blade which are or should be fitted to a propeller, and indeed this question has no direct effect upon the general problem. The mass of air dealt with by the propeller is represented by a cylinder of indefinite length having a diameter equal to that of the propeller itself, and the rate at which that cylinder is projected to the rear depends upon the pitch of the revolutions, and not at all, theoretically, upon the number of blades. Theoretically one blade properly designed working under suitable conditions would be sufficient, and even then there would be no need, as some inventors have imagined, to make that blade a complete helix so that it encircled its shaft. One blade would, of course, be out of balance by itself; hence it may be assumed that two blades constitute a minimum, and in marine work it is common to find at least three blades because the balance is then better still. With aerial propellers, so far as they have at present been constructed, two blades are very



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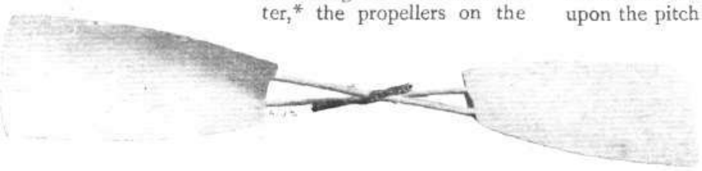
A neat method of fixing a two-bladed propeller to the crank-shaft is to use the shanks of the blades as bolts, and to fasten them by nuts to the boss, as is shown in the above illustration of the Voisin flyer.



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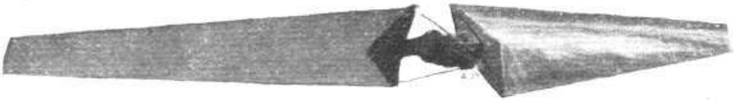
The propeller on the Wellman airship is an example of how a pair of tubular rods may be used for the attachment of light metal blades.



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In the Hollands propeller the blades are shaped something like cheese-cutters, having concave faces, and being tapered from the root to the tip.

* See FLIGHT, January 9th, page 30.

commonly adopted, and in the case of wooden propellers this results in the simplest form of construction. If too many blades are employed they will interfere with one another, but although four blades is probably as many as would be required in most cases, it is not improbable that good results would be obtained in aerial work with propellers having as many as six blades.

"Flight" Copyright.

In the Lamplough propeller the blades are each made from a single piece of wood, and are hollowed out from the root towards the tip. They are mounted in a hollow copper stamping which forms the boss.

A Simple Rule.

In his very able treatise on Aerodynamics, F. W. Lanchester, whose interesting treatment of the problem of the aerial propeller should certainly be studied by those interested in this subject, gives the following rough and ready equation for the number of blades permissible :—

Number of blades =

$$2{\cdot}5\,\frac{r_2 + r_1}{r_2 - r_1}\,;\ \text{where}\left\{\begin{array}{l} r_2 = \text{radius from axis to tip.} \\ r_1 = \text{radius from axis to inner extremity.} \end{array}\right.$$

By increasing the number of blades the thrust is, of course, distributed over a larger area, and the grip of the propeller upon the air column is more evenly distributed ; but, on the other hand, the weight would be considerably increased, and on a machine like an aeroplane it would probably become advisable to consider if greater advantages might not ensue from using more propellers, with the object of distributing the propeller streams over the aeroplane surfaces with a view to facilitating starting.

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A curious feature of the propeller on the Pischoff biplane is the lip formed on the periphery of the blade, which thereby somewhat resembles a big wooden spoon.

Hollow-faced Blades.

Although in what has already been said the angle of the blade at any section has, for convenience, been supposed uniform, such is not really the case in a well-designed propeller, any more than the surface of an aeroplane is perfectly flat in a well-designed flyer. It is a very convenient and proper way to regard a propeller blade as an aeroplane specially designed to traverse a helical path, and from what is already known of aeroplanes the immediate deduction will then be that the face of the blade should be curved ; in practice it will be found that this is actually a feature of the propellers commonly in use. It is unnecessary to enter into an examination of the amount of the curvature at the present moment, although it is very important to point out that it exists. There are various ways of regarding this characteristic of a propeller-blade, apart from that of the aeroplane simile already mentioned, and one of the most convincing is to try and appreciate the desirability of having the air which the propeller-blade is acting on at the moment set in motion evenly and without shock ; in other words, to avoid a " fierce clutch " effect.

Easy Starting.

This condition obviously cannot result if the face of the propeller-blade represents a flat plate set at a fixed angle, because such a blade as that would cut into the air molecules with a considerable shock, instead of taking hold of them gently and accelerating them by degrees so that they leave the trailing edge of the blade with a velocity which would have been theoretically established by a flat plate at some equivalent angle. A blade with a curved face, it may be observed, has essentially an increasing pitch from the cutting to the trailing edge considered through any particular section, and it is only the mean effective pitch, equivalent to this range, which has been referred to in the foregoing paragraphs.

Wide and Narrow Blades.

The necessity of this increasing pitch in a well designed propeller is a very good reason why the width of the blade is limited, and is commonly much narrower than a good many people imagine to be correct. To make a very wide blade on these lines would very soon infringe the limiting angles already discussed, and to make a very wide blade with flat face does not do any good either, because the air molecules have already been accelerated up to their final velocity during their contact with an initial minimum width, so that any blade surface beyond this is wasted except so far as it may be required for increasing the stiffness.

The Best Position.

Apart from considerations affecting the design of the propeller itself, the efficiency of a propeller is also considerably influenced by its position, but it is questionable whether the deductions which have been made in marine work on this point will find quite the same parallel in the case of the flying machine. A boat moving through the water sets in motion the water immediately around it, which is caused to travel in the same direction because of the skin friction between it and the vessel's sides.

There is thus created a wake (commonly called the frictional wake) behind the boat, consisting of a column of water flowing after the boat, but at a lesser velocity, and this frictional wake will come into existence whether the boat itself be propelled or towed. Inasmuch as the wake in question has any velocity at all, it represents a certain amount of energy, which will be lost unless means are taken to utilise it, and the simplest way of making use of the frictional wake is to place the propeller in such a position that it can act upon it, that is to say, behind the boat.

Pulling *v.* Pushing.

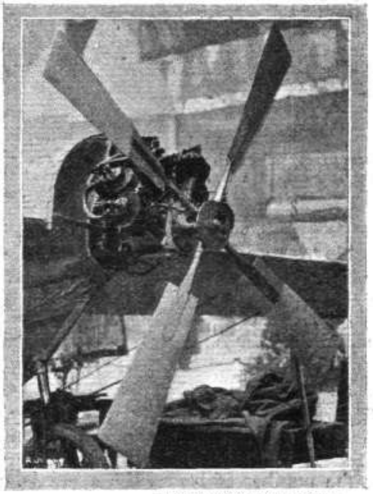
In such a position the effect of the propeller in action is to bring the wake to rest, so that, assuming the conditions to be suitable, it is possible for a boat to be propelled without a column of water being actually projected rearwards from the propeller, the slip in this case being neutralised by the wake, or, in other words, the abutment for the thrust being established by taking momentum out of the water instead of imparting momentum to the water. It must, of course, be understood that the power which set the wake in motion was derived indirectly from the propeller itself, and that there is no suggestion of getting work done without the expenditure of a corresponding amount of energy. On the other hand, however, it does show very conclusively that a boat can, theoretically, be propelled with less horse power than it can be towed, because in the former case the energy which the boat puts into the wake is retrieved.

The Wake from a Flyer.

When it comes to applying this argument to a flying machine, the same conclusions are not necessarily deduced, because the conditions are different. A biplane, for instance, is very unlike the hull of a boat, and the skin-friction of the air upon a decently smooth surface is not comparable with that of water, so that in any case the presence of an appreciable frictional wake seems to be a matter requiring experimental demonstration. Even if the wake exists, moreover, it does not necessarily follow that a propeller is better than a tractor screw on these grounds alone, because with the latter arrangement the slip from the screw itself might be turned to advantage by its action upon the aeroplane surfaces by increasing their virtual velocity.

Tractor Screws *v.* Propellers in Practice.

These points, however, need a considerable amount of experimental evidence before they can be decided one way or the other, and in the meantime there are constructional considerations to be taken into account which are quite sufficient to throw the balance one way or the other. In the R.E.P. monoplane, for instance, the presence of a tractor-screw direct-coupled to a little engine perched up on the nose of the machine, is as simple an arrangement as anyone could wish for, considered purely from a mechanical point of view. In biplanes it is more convenient to put the engine somewhere else, and this position is commonly such as to facilitate the use of one or more propellers.



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On the R.E.P. monoplane the propeller forms a four-bladed tractor-screw in front.

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LOS ANGELES FLYING MEETING.

IN our issue of last week we were able to give details regarding the wonderful height record made by Paulhan and the speed records of Curtiss. After these performances, perhaps the most noteworthy flight was that of Paulhan on Friday of last week, when he flew across country to San Pedro and manœuvred above the fort and the harbour at a height of about 900 ft. Altogether he flew some 20 miles during 35 mins. On coming down Paulhan stated it would have been easy for a fleet of aeroplanes to attack the harbour defences, and destroy the city too. He said it would have been easy for him to have carried up 375 lbs. of dynamite, and with a sufficiently powerful motor he could have gone up to a height of 10,000 ft., when it would have been impossible for any gunner to hit the machine, as it would then appear such a small speck in the sky. On the previous day Paulhan carried two passengers on his Henry Farman machine for a short distance. On the Friday Curtiss took up Lieut. Paul Beck, who during the flight attempted to drop bags of sand representing bombs from a height of 250 ft. He failed, however, to hit the marks by from 15 ft. to 25 ft. In a speed test between Curtiss and Paulhan the former covered a mile and a half in 2 mins. 12 secs., while Paulhan took 2 mins. 48 secs. for the same distance.

In a match on the 18th over 10 laps, 16 miles, Curtiss was timed in 23 mins. $43\frac{3}{5}$ secs., while Paulhan's time was 25 mins. $5\frac{1}{5}$ secs. On Monday Paulhan set out to beat the endurance record, but stopped after covering 75 miles in 1h. 55m. $27\frac{2}{5}$s., mainly owing to a misunderstanding with regard to the course he was following.

On Tuesday Paulhan made another long flight across country, and this in spite of the fact that a very heavy wind was blowing. At one time it was felt that it would be impossible to do any flying, but in the afternoon the Henry Farman machine was brought, and Paulhan started off, after making a preliminary circuit of the Aerodrome, in the direction of Arcadia, some 23 miles away. On arrival there, he was at a height of 1,000 ft., and manœuvred over the race track. He then started off on the return journey, and, having the wind against him, gradually rose to a height of 2,130 ft., where calmer currents prevailed. Naturally this spectacular flight evoked great enthusiasm among the spectators, and on landing Paulhan was carried shoulder high across the aerodrome.

Madame Paulhan accompanied her husband during a cross-country flight of 22 miles on Wednesday, which lasted 33 mins.

THE 1904 WRIGHT PATENT.

BOTH as a matter of interest, and also on account of its importance as a record, we publish below a *résumé* of the Wright Brothers' patent, No. 6732 of 1904. It was originally published in *The Automotor Journal*, before FLIGHT made its appearance, so that no apology is needed for bringing it forward at this late period.

This patent is of extreme interest, and should certainly be perused by all who are not already acquainted with it, as it deals with many of the points which are often raised in connection with the Wright machine :—

The objects of our invention are, first, to provide a structure combining lightness, strength, convenience of construction, and the least possible edge resistance ; second, to provide means for maintaining or restoring the equilibrium of the apparatus ; and, third, to provide efficient means of guiding the machine in both vertical and

Fig. 1

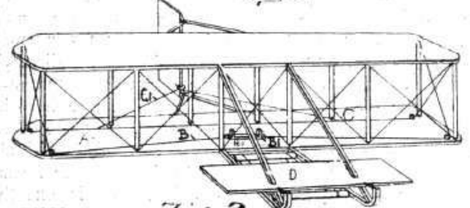
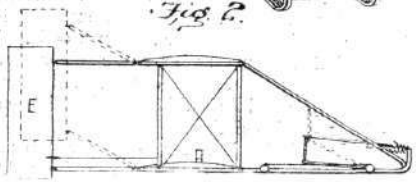


Fig. 2.



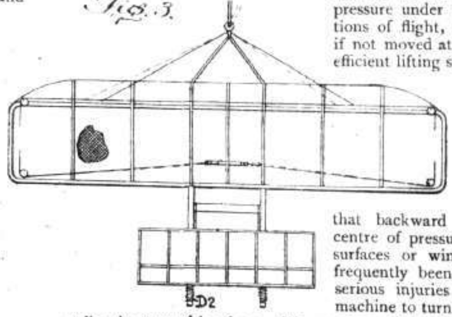
horizontal directions. We obtain these objects by the mechanism shown in the accompanying drawing, in which Fig. 1 is a view in perspective of the machine, Fig. 2 a side elevation, and Fig. 3 a top plan view.

The superposed horizontal surfaces, A, formed by stretching cloth upon frames of wood and wire, constitute the "wings," or supporting part of the apparatus. They are connected to each other through hinge-joints by upright standards and lateral stay-wires, which, together with lateral spars of the wing framing, form truss systems, giving the whole machine great transverse rigidity and strength. The hinge-joints admit of both flexing and twisting movements, and may be either ball and socket joints, or any joint of sufficiently loose construction to admit of the movements specified. The object of joints having both flexing and twisting movements is to permit superposed wing surfaces, or parts thereof, when joined together by upright standards, to be twisted or bent out of their normal planes for the purpose hereafter specified. We do not restrict ourselves to the use of any particular form of joint, nor to its use at any particular number of places.

One end of the rope, B, is attached near the rear corner of the upper surface, passes diagonally downward around pulleys, and diagonally upward to the corresponding corner at the opposite end of the machine. The rope, C, is attached to the front corner of the upper surface, passes around pulleys, and back to the opposite upper corner. The movable cradle, B^1, is attached to the rope, B, at the point where the operator's body rests, and provides a means of imparting movement to the ropes, B and C. The operator lies prone on the lower surface, his hips resting in the cradle, and his hands grasping the roller, D^1, which actuates the front rudder, D. The ropes maintain the fore and aft positions of the two surfaces, A, with respect to each other, and by their movement impart a twist to the entire structure, including the wings, A, when the cradle is moved to right or left by the operator, the motion is communicated through the ropes and the upright standards in such a manner that the wing surfaces are twisted, the rear edge of the wing tips being drawn downward at one end of the machine and drawn upward at the other, thus presenting the left set of wing tips to the wind at a greater or a less angle than the right. When in flight, the end having the greater angle will necessarily rise and the other end will sink, so that the lateral balance of the machine is under control through twisting movements of the wing tips by the operator, by means of the cradle.

The flexible front rudder, D, is mounted upon struts by attachment to the cross-stick, which is located near the centre of pressure, so as to form a balanced rudder. The up and down motion of the front edge of the rudder is in part restrained by springs, D^2. The rear edge is raised and lowered by means of the axles, D^1. The restraining action of the springs causes the ribs to bend when the rear edge is raised or lowered, thus presenting a concave surface to the action of the wind, and very greatly increasing its power as compared with a plane of equal area. By regulating the pressure on the upper and lower sides of the rudder, through changes of angle and curvature, a turning movement is communicated to the main structure and the course of the machine is directed upward or downward at the will of the operator, and the longitudinal balance maintained. Contrary to the usual custom, we place the horizontal rudder in front of the main surfaces or "wings" at a negative angle, and use no horizontal tail at all. By this arrangement we obtain a forward surface which is almost free from pressure under ordinary conditions of flight, but which, even if not moved at all, becomes an efficient lifting surface whenever the speed of the machine is accidentally reduced very much below the normal, and thus largely counteracts that backward travel of the centre of pressure on the main surfaces or wings, which has frequently been productive of serious injuries by causing the machine to turn downward and strike the ground head on. We are aware that a forward horizontal rudder of different construction has been used in combination with a supporting surface and a rear horizontal rudder, but this combination was not intended to effect and did not effect the object which we obtain by the arrangement of surfaces here described.

Fig. 3.



The vertical tail or rudder, E, is attached through universal joints to two pairs of struts, which lie in parallel horizontal planes, and are connected to the rear edges of the main surfaces by hinged joints. This combination secures the tail rigidly in a vertical position, but enables it to turn on a vertical axis, and also to rise bodily in case it strikes the ground and thus escape breakage. The cords, C^1, are tiller-ropes which connect the rudder-wheel to the rope, C, which, in conjunction with the rope, B, imparts the twisting motion to the wing tips as heretofore described. By this method of attachment the same motion of the ropes which actuates the wing tips also presents to the wind that side of the vertical rear-rudder which is toward the tip having the smaller angle of incidence. The wing tip presented to the wind at the greater angle, under the usual conditions of flight, has both greater lift and greater drift, or resistance, than the other. The wing with the greater angle, therefore, tends to rise and drop behind, while the other sinks and moves ahead. Under these circumstances the longitudinal axis of the machine tends to turn toward the wing having the greater angle, while the general course of the machine through the air tends toward that wing which is the lowest, with the result that a wide divergence soon arises between the direction which the machine faces and its actual direction of travel. By the use of a rear movable vertical rudder, so operated as to present to the wind that side which is toward the wing having the least angle, we obtain a turning force opposite to and greater than that arising from the difference in the resistance of the two wings, and thus are able to keep the longitudinal axis of the machine approximately in coincidence with the line of flight.

The principal claims are :—The use of jointed standards, diagonal stay-wires, and a device for twisting the surfaces.

The patent concludes with fourteen claims, covering all the combinations mentioned in their specification and among which the following are the most important points :—Jointed standards between the aeroplane surfaces ; diagonal stay-wires ; device for twisting the surfaces ; arrangement of operating ropes ; vertical rear rudder supported on hinged spars ; laterally stiff and longitudinally flexible horizontal front rudder operated as described ; arrangement of the threads of the cloth forming the aeroplane surfaces in a diagonal direction.

STABILITY OF THE CLARKE GLIDER.

BY T. W. K. CLARKE.

IN FLIGHT of December 4th, a correspondent, "P. K.," raised the question of the longitudinal stability of a machine having a small plane in front and a large one behind. In answering, you referred to my models, quoting Lanchester to the effect that the reason of this stability was a problem of some obscurity. In a paper read before the Aeronautical Society last year, I referred to this point, and gave an explanation of the action, which is somewhat akin to that of the dihedral angle in connection with transverse stability. Possibly it may be of interest to recapitulate the argument :—

Denote by A (Fig. 1) the area of the large back surface, and by α its inclination to the line of flight.

FIG. 1.

Denote by B (Fig. 1) the area of the small front surface, and by β its inclination to the line of flight.

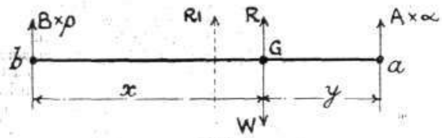


FIG. 2.

a and b are the centres of pressure of the two surfaces during flight.

Denote by Y the inclination of the front surface to the back surface. (In my models this is generally about 2½°.)

For simplicity imagine the two surfaces to be flat.

We see that we have $\beta = \alpha + Y$.

Now since α and β are small (6° or 7° at most) we know that the intensities of the air pressures (*i.e.*, lbs. per sq. ft.) on A and B are roughly proportional to their inclinations α and β, and therefore the total pressures on the surfaces are proportional to $A \times \alpha$ and $B \times \beta$, and may be supposed to act upwards at a and b, as shown in Fig. 2.

The resultant of these two pressures will be a force R acting upwards and dividing ab into two sections, x and y, proportional to $A \times \alpha$ and $B \times \beta$.

$$i.e., \ \frac{y}{x} = \frac{B.\beta}{A.\alpha} = \frac{B\,(\alpha + Y)}{A.\alpha} = \frac{B}{A}\left(1 + \frac{Y}{\alpha}\right)$$

For steady flight this force must just balance the weight, W (Fig. 2), and therefore must act upwards through the centre of gravity.

Now suppose that, for some cause or other, the inclination of the machine to the direction of flight, *i.e.*, α (and also β) is reduced. Then $\frac{\gamma}{2}$ is increased, for γ is a constant of the machine. Also $\frac{y}{x}$ is increased, *i.e.*, y is increased and x decreased. The resultant of the pressure then moves forward to R^1 ahead of G, and we see that we get a righting couple that tends to increase α again. Thus if α was increased by accident the machine would tend to tilt so as to bring α back to its original value. Hence we see that such a disposition of surfaces tends to keep a machine at a constant inclination to the direction of motion.

If such a machine, while being propelled by a screw capable of keeping it flying in a horizontal line, should at any time begin to turn downwards (keeping, of course, the same inclination to the direction of motion—in this case a curve), its velocity forward will begin to increase owing to the help given by gravity, and it will, therefore, get an excess of pressure, and begin to rise again until its velocity becomes normal again, *i.e.*, the machine will be stable (longitudinally) in the ordinary sense. But this recovery motion may be overdone and an oscillation set up, which may either die out or increase. The former is perfect stability, the latter culminates in capsizing of the machine. As to which will happen depends on the actual values of the areas, moment of inertia, &c. The calculation is exactly similar to that initiated by Mr. Lanchester, except that his calculation is a particular case (viz., when $\alpha = \theta$). I do not propose to inflict it upon your readers (nor have I got it or the formula by me now). The deductions as to I (moment of inertia) and l (in this case the distance ab), &c., are, of course, also similar.

Mr. Lanchester, in his book, refers to the large back surface of my machine as "a species of pertrophied tail." I think I should be just as logical to refer to the small tail surfaces of his beautiful models, as also to those of others having tails, as "atrophied sustaining surfaces." On the Blériot and Antoinette machines it is interesting to note that the essential difference is that in the former the back surface is a sustainer, while in the latter it is a pure tail, *i.e.*, directive only.

The advantage of having the small surface in front is that interference, due to the rear surface being in or near the wake of the front surface, is reduced. My models have in this respect taught me a great deal, and so far as models are concerned the arrangement of the leading plane gives a handier position for the centre of gravity.

May I be allowed to mention that in my 1907 patent I claim a machine "having two sustaining surfaces set transversely across the framing, in which the front one is considerably smaller than the back." This, I believe, is good, and I mention it as I believe there are some people making such machines (for sale) who may not be aware of my claim.

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"WILD-CAT" SCHEMES AND "PREMIUM" HUNTERS.

THE following warning has been issued by the Aeronautical Society which should be noted against the time any flagrant cases of promotion see the light of publicity. We have several times given our views upon this same subject :—

The Council of the Aeronautical Society of Great Britain, in view of the many companies now being formed or about to be formed for the purposes of exploiting various types of flying machines, or for dealing generally in aeronautical appliances, consider it their duty to warn the public against investing in any such concerns without previously making thorough inquiries. They also warn the public against paying premiums, &c., for instruction in aeronautics without satisfactory evidence that the instructor is fully qualified to impart the same.

These warnings are issued in the interests of the aeronautical science and industry as well as of the general public, for it will be evident that any cases of fraud in the early stages of a new industry would seriously militate against its development and prosperity.

EDWARD P. FROST,
President Aeronautical Society of Great Britain.

The Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

Committee Meeting.

A meeting of the Committee was held on Tuesday, the 18th inst., when there were present :—Mr. Roger W. Wallace, K.C., in the chair, Mr. Ernest C. Bucknall, Mr. Martin Dale, Mr. V. Ker-Seymer, Mr. J. T. C. Moore-Brabazon, Hon. C. S. Rolls, Mr. Stanley Spooner, and joint secretaries Capt. E. Claremont, R.N., and Harold E. Perrin.

New Members.—The following new members were elected :—

Henry A. Bellows.	Alfred Michelson.
Edward G. Brinkley.	Clinton Rhoades Peterkin.
L. F. de Peyrecave.	Edward Petre.
Frank Haskoll.	H. A. Petre.
C. R. L. Kenworthy.	George C. Sherrin.
Lieut. J. B. Leefe, R.G.A.	J. W. F. Tranmer.
Capt. T. Orde Lees.	F. M. J. White, B.Sc.
Lionel H. Mander.	Joseph Zeitlin.
J. A. Mays.	

Oxford and Cambridge Graduates.

The Committee of the Aero Club have decided to admit to Membership Undergraduates of the Universities of Oxford and Cambridge at an Annual Subscription of £1 1*s.* during the time they are in residence.

Membership.

The Committee have decided not to increase the annual subscription of £2 2*s.* for the present, but new members will now pay an entrance fee of £2 2*s.* in addition to the subscription.

Heliopolis (Cairo) Aviation Meeting.

The Aero Club will be represented by Captain the Hon. Claud Brabazon and Mr. A. M. Singer.

Aviation Pilot Certificate.

Mr. C. Grahame-White, having complied with the Rules of the Aero Club de France, has been granted an Aviation Pilot Certificate on the recommendation of the Aero Club of the United Kingdom.

Library.

Several Members have very kindly presented books to the library, notably Sir David Salomons, who has given an original edition of "Histoire Aeronautique les Monumens."

The Committee trust that other Members will assist with any books of interest.

Club Premises.

The Committee hope that now the Club Rooms have been opened, the Members will take advantage of them. In addition to newspapers, current literature dealing with aviation will be found.

Aero Exhibition at Olympia.

The full particulars regarding the Model Section will be issued this week, and a supply will be sent to each provincial aero club for distribution amongst its members. Space will be given free, and the Aero Club will erect suitable stands and provide the necessary attendants. In order to partly cover this expense a charge of 10*s.* will be made to each exhibitor, who will be provided with a free pass during the whole exhibition.

Medals will be awarded by the Aero Club and the Aerial League of the British Empire.

Entries and all inquiries must be made to the Aero Club, 166, Piccadilly, London, W.

Members wishing to exhibit full-sized machines are requested to communicate at once with the Aero Club.

Alexander £1,000 Prize Competition.

Copies of the rules and entry forms for this competition for aerial motors can be obtained from the Secretaries.

The British Empire Michelin Cup.

The Michelin Tyre Co. has presented to the Aero Club of the United Kingdom, for competition by British aviators, a trophy of the total value of £500.

Annually, for five years, a replica of this trophy, together with a sum of £500 in cash, will be given to the successful competitor. This trophy will be competed for under the following conditions, *which shall apply for the first year only*:—

Conditions.—1. The holder of the cup for 1909 will be the competitor who, on March 31st, 1910, shall have accomplished the greatest distance on any heavier-than-air machine without touching the ground.

2. The minimum distance to be covered in order to qualify for this prize shall be 5 miles round two or more posts for the necessary number of circuits.

3. Entries must be made in writing to the Secretary of the Aero Club, 166, Piccadilly, London, W. At least two clear days' notice must be given by a competitor before making his attempt.

4. An entrance fee of 10*s.* will be charged, and a further sum of £1 must accompany every notification of an attempt by any competitor under these rules. Every competitor must be a member of some recognised body dealing with aerial matters in the Empire, and shall, if called upon, satisfy the officials of the Aero Club of his ability to fly at least 500 yards, before making any attempt under these rules.

5. All attempts must be made between the hours of sunrise and sunset, in the presence of the official or officials appointed by the Committee of the Aero Club.

6. The recognised flying ground is at Shellbeach, Island of Sheppey, but the Committee of the Aero Club will be willing to entertain any other ground subject to the competitor paying the necessary expenses incurred.

7. The start for the records will be reckoned from the crossing over the starting line in actual flight.

8. Competitors must be British subjects from any part of the Empire, manipulating a British-made machine. All the principal parts of a competing machine must be British made. All decisions applying to this rule shall be given by the Chairman of the Aero Club, Mr. Roger W. Wallace, K.C., and failing him, by an arbitrator nominated by the President of the Institution of Civil Engineers. This shall not be held to apply to raw material, but all finished or manufactured parts of such machine must comply with the above condition.

9. The decision of the officials of the Aero Club on all matters connected with this competition to be final and without appeal.

E. CLAREMONT, CAPT. R.N.,
HAROLD E. PERRIN,
166, Piccadilly. Joint Secretaries.

PROGRESS OF FLIGHT ABOUT THE COUNTRY.

(NOTE.—Addresses, temporary or permanent, follow in each case the names of the clubs, where communications of our readers can be addressed direct to the Secretary. We would ask Club Secretaries in future to see that the notes regarding their Clubs reach the Editor of FLIGHT, 44, St. Martin's Lane, London, W.C., by 12 noon on Wednesday at latest.)

Sheffield Aero Club (36, COLVER ROAD, SHEFFIELD).

AT a committee meeting of the above club, held on the 12th inst., it was decided that the club badges and rules should be ready before the next general meeting. It was also agreed that suitable premises be obtained, in which the construction of a full-size machine could be undertaken. The committee hope to complete negotiations for the workshop before long, and will then get the machine in hand at once. Members are requested between now and the next meeting to draw up any ideas they may have regarding the constructional details of a biplane glider, so that they may be then considered.

S.W. England Aeronautical Soc. (51, ST. LEONARD'S RD., E. SHEEN)

ENTRIES for the model competition should be sent at once to the secretary, together with the entrance fee of 1*s.* and 1*s.* 6*d.* for every model entered. It will be seen that the lowness of the fees enables every member to compete. Mr. A. J. Fransella starts the prize list with a dress watch. The ribs of the club monoplane are being constructed, and gentlemen who now join will be afforded the experience of building an aeroplane themselves. Any gentlemen who wish to offer prizes are requested to communicate with the secretary. Members wishing to subscribe to the monoplane fund should send in their donations at the earliest possible date.

DESIGN AND CONSTRUCTION OF AEROPLANES.*

By J. P. CHITTENDEN and L. H. ROBINSON.

IT is the desire of the authors in placing this paper before the Society, not only to give the results of their own and others' experiments in the design and construction of aeroplanes, but also to afford an opportunity of discussing a subject which now holds a prominent part in the minds of those interested in the science of aviation.

There is no doubt that in the earliest times this science commanded man's attention, but not until the last three years can it be said that man has actually achieved flight with machines heavier than air, although, previous to this, machines have been made which have risen from the ground, the most notable being that of Adder in 1890, with a steam-driven mono-

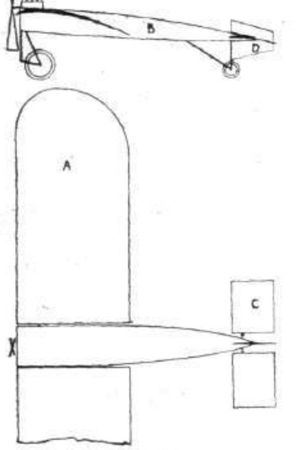

FIG. 1.

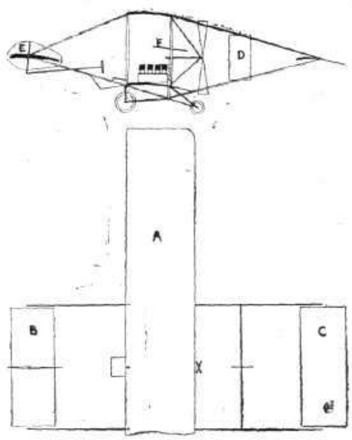

FIG. 2.

plane weighing 1,100 lbs. and 54 ft. across the tips of the wings. The engine is worthy of note, it being a 4-cylinder compound, weighing 70 lbs., and said to have developed 25-h.p. The trials of the machine were conducted secretly, so that very little definite information of its performances is to be had, but it is reported to have flown several hundred yards.

The early experiments of Otto Lilienthal in 1891 to 1896 with his gliders; Prof. Langley with his large power-driven model; Sir Hiram Maxim in 1893 with the largest machine which perhaps has ever been built, certainly led the way to those more recent experimenters who have brought the knowledge they obtained to a practical issue. The total lifting surface of Sir Hiram Maxim's machine was 6,000 sq. ft., the horse power of the steam engine being 360. With three men on board the weight was about 8,000 lbs. This machine was tried on a specially prepared track fitted with guard rails, and undoubtedly lifted, as these rails were torn away, causing the machine to be severely damaged. It was a great loss to aviation that Sir Hiram Maxim did not continue his valuable experiments in this direction, as the thorough way in which he attacked the problem in its early stages, and the careful manner in which he collated data, would, if carried on, have given to mankind a valuable foundation for future work.

Santos Dumont, on October 23rd, 1906, with a machine constructed by a French firm, flew 200 ft. at a height of 6 to 7 ft. from the ground. The machine was of the box form, and the main planes were set at a dihedral angle; but it remained for Farman, in January, 1908, and Wright, in August, 1908, to prove that heavier-than-air machines could be made to fly and manœuvred satisfactorily. It is probable that this result would have been achieved sooner had a light form of petrol motor been obtainable.

As the subject of aviation is a large one, the authors of this paper have decided to confine themselves to aeroplanes in the more strict sense, that is to say, machines with one or more planes that are fixed, except for the purpose of control, driven by a self-contained motor; this naturally excludes all types of helicopeters and orthopters.

Aeroplanes may be divided into two types, namely, monoplanes, an example of which is Blériot's machine, and multiplanes, of which the Wright and Voisin are the most common. The latter may be divided into two classes, those which aim at natural lateral stability, and those which rely on mechanical movements to obtain lateral stability.

Monoplanes.—Fig. 1 shows the general outline of a monoplane.

A. Being the main wings, which are in all cases double-covered.

B. The body; this being made up in the form of a lattice girder of box section, of wood struts and wire ties, and is usually encased in fabric to reduce air friction. When water-cooled engines are used, the radiators are in most cases placed along the side of the body.

C. The elevator is placed at the back of the machine, and in conjunction with the rudder, *d*, forms a tail. It is probable that before long the vertical plane may be dispensed with, and side steering effected by movement of the wings alone.

Multiplanes.—Under this heading will be dealt with the most common form, namely, the biplane, which is shown in Fig. 2.

A. Main planes; both the single and double-covered method is employed, the planes being superposed and braced in the form of a lattice girder.

B. The elevator is usually constructed in a similar manner to the main planes. Although the initial function of the elevator is to assist in raising the machine from the ground, in actual flight it is used principally to damp longitudinal oscillations, the actual elevating being usually accomplished by varying the speed of the engine.

C. The tail seems to be an accessory of doubtful utility, except in the Voisin type, where it is made of box form.

D is a vertical plane in line with rudder, E, to assist in directional steering.

F. Ailerons, which are used to obtain lateral stability, and take the place of flexing the main planes.

Having described the general forms of heavier-than-air machines, attention will now be given to the design and construction of the various parts in detail.

Planes.—Of all the parts of latter day machines, the planes or lifting surfaces are perhaps the most near perfection. To Otto Lilienthal and Horatio Phillips we owe the aerocurve or curved plane, which has enabled a greater reduction to be made in the necessary lifting area than if a flat surface was employed.

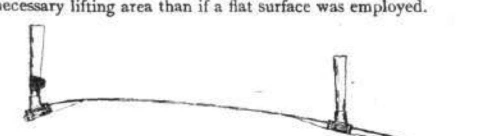

FIG. 3. FIG. 3A.

In Figs. 3 and 4 are illustrated the most common forms of planes designed on this principle. Fig. 3 is a view of a single-covered plane; Fig. 3A showing the more correct construction, as this allows the air to have a free run on the lower surface. Fig. 4 is a view

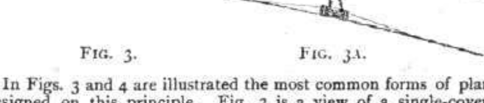

FIG. 4.

showing the section of a double-covered plane. This is undoubtedly the better form, as the frictional losses are greatly reduced, although the mechanical construction is somewhat more complicated than with the single covering.

To consider the design of these planes on a purely mathematical basis is an utter impossibility. It has been proved repeatedly by

* Paper read before the Rugby Engineering Society.

experiment that a well-designed aerocurve will lift more weight per square foot at a given velocity and angle of inclination than can be lifted according to theory.

In Fig. 5, taking the under side of the cutting edge as being parallel to the direction of flight, and the trailing edge as making an angle α with the horizontal, the air is deflected downwards with a velocity of V sine α, where V = the forward velocity in feet per

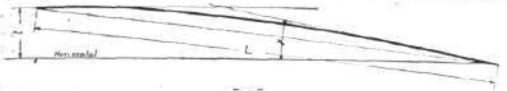

FIG 5.

second. The weight of air dealt with = V × breadth of plane × l × weight of air per cubic foot, and the momentum imparted downwards to the air

$$= \frac{\text{breadth of plane} \times L \times \text{weight of air per cubic foot} \times V^2 \text{ sine } \alpha}{g}$$

this being the vertical force exerted by the wings on the air, that is, the force tending to lift the planes.

Taking a speed of about 40 miles per hour, and the ratio $\frac{L}{l} = 10$, it will be found that the theoretical lift is only about ·87 lb. per square foot, whereas it has been proved from experiments carried our by the authors that a well-designed aerocurve under these conditions will lift nearly $2\frac{1}{2}$ lbs. per square foot.

The question of drift to lift, in the design of a plane, should be carefully considered, as the drift of the plane determines the horse-power required.

In the case of a flat surface, or plane, the ratio drift to lift varies as the sine to the cosine of the angle of incidence, if the pressure is normal to the chord of the plane.

In the case of an aerocurve, or arched plane, it has been found that the actual drift is slightly less than that obtained by the above method, and it can only be assumed that with a curved surface the pressure must act in a direction slightly forward of the line normal to the chord.

This theory has been upheld by many experimenters, and the authors themselves have found, by their experiments, that with Plane A (Fig. 6) the drift obtained was only slightly in excess of the theoretical drift, and, making allowance for skin friction and head resistance, the actual drift was slightly less than that calculated; and with Plane C the actual drift was somewhat larger than the theoretical drift; but in practice it is advisable to take the calculated drift, and allow for head resistance and skin frictional losses, when deciding upon the horse power required.

The design of such an aerocurve may be obtained in the following manner: The underside of the front edge is given a negative angle of about 10° for about an eighth of the length of the section, after which the underside is given a positive angle, gradually increasing to the trailing edge to about 6°, this angle varying slightly with the length of section.

The greatest depth of camber should be at about one-third of the length of section from the front edge, and the total depth measured from the top surface to the chord at this point should not be more than one twelfth of the length of section, as planes with a greater arch are liable to be very unstable at small angles of incidence owing to the fact that a large portion of the upper surface is exposed to wind pressure, thus causing a reversal of the centre of pressure.

Having arrived at the correct shape of the planes, the amount of lifting surface required to lift a machine of given weight will now be considered.

In finding the amount of area required, it is necessary also to consider the length of cutting edge. It has been found by experiment that the aspect ratio should not be less than 5 : 1. By "aspect ratio" is meant the ratio of length to breadth of plane. For an aspect ratio of from 5 : 1 to 8 : 1, and with reasonable angles of incidence, say, from $2\frac{1}{2}°$ to 15°, the following empirical formula,

$$P = \frac{V^2 \times \tan \alpha}{64},$$

where P = pressure in lbs. per square foot,
V = velocity in miles per hour,

has been found by the authors to approximate very closely the results obtained from their own and others' experiments, and may be safely used with well-designed aerocurves under normal conditions.

In Fig. 6 the results obtained from various forms of planes are plotted, and it will be noticed that the points obtained from plane A vary very slightly from the formula given. The planes used in the tests are shown at A, B, C. The aspect ratio in all cases was 5 : 1.

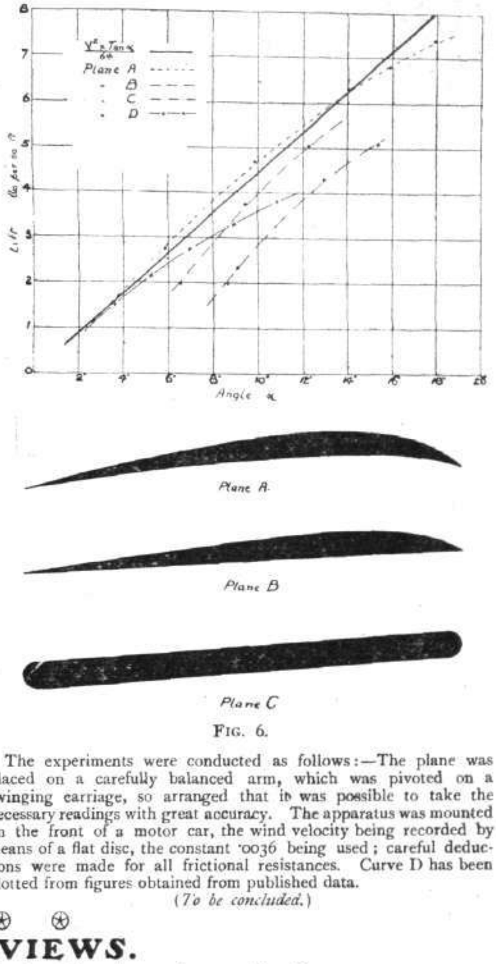

FIG. 6.

The experiments were conducted as follows:—The plane was placed on a carefully balanced arm, which was pivoted on a swinging carriage, so arranged that it was possible to take the necessary readings with great accuracy. The apparatus was mounted on the front of a motor car, the wind velocity being recorded by means of a flat disc, the constant ·0036 being used; careful deductions were made for all frictional resistances. Curve D has been plotted from figures obtained from published data.

(To be concluded.)

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BOOK REVIEWS.

Comment l'Oiseau Vole, Comment l'Homme Volera.

THIS work by Wilhelm Kress has been translated into French by R. Chevreau, and deals in a theoretical manner with various aspects of the problem of flight, starting at the fundamental point of considering the action of the wind on bodies exposed to its influence. A certain amount of space is devoted to the subject of soaring flight in birds, and there is a chapter on automatic stability. Some chapters are given over to early experimental work, but the book does not deal with modern machines. (Paris: L. Vivien. 3 fr. 50 c.)

Etudes Experimentales sur les Zoopteres.

IN the introduction Dr. Paul Amans explains that the zooptere is a blade having a form based on the geometrical design of natural wings, and the book is given up to a discussion and investigation of the salient points which ought to be taken into consideration by anyone anxious to produce artificial wings or surfaces having their essential characteristics. The author's study of the subject was evidently of a most painstaking character, and should be of considerable interest to those who wish to start their designs from the standpoint of nature. (Paris: L. Vivien, 2 fr.)

MILITARY ASPECT OF DIRIGIBLE BALLOONS AND AEROPLANES.

By COL. CAPPER, R.E.

IN discussing the bearing on warfare of any new and untried instrument of war, we must recognise that we have no sure grounds of actual experience on which to base our opinions, but at the same time we are more likely to work on correct lines if we carefully study the results of experiments made in peace time, inquire into developments which are likely to occur in the near future, and trace from these data their probable results on military operations.

The progress already made, however, is great enough to force on all nations, who may sooner or later have to embark on military operations.

Dirigible Balloons.—Small balloons, like the American "Baldwin," the German "Clouth," and the British "No. 1," are only able to attain a speed of from 16 to 22 miles per hour, and to continue at that speed at from one to four hours with only two as a crew; larger types, as the French "Republique," the German "Parseval," and "Gross," and the Italian military dirigible, have made journeys of twelve and fourteen hours' duration at an average speed of about 30 miles per hour with six or seven passengers, whilst the huge Zeppelin has remained in the air for as much as thirty-eight hours, has made numerous long journeys to different parts of Germany with a crew of twelve persons, and is said to be capable of a speed of approaching 35 miles per hour.

These speeds, though considerable, are far from being sufficient for all purposes, as the speed of the wind at high altitudes surpasses 30 miles an hour on very many days in the year. The dirigibles of the present day are capable of journeys of from 300 to 700 miles under favourable conditions, and are capable of carrying a full working crew besides officers for reconnoitring. They have also been fitted with wireless telegraph apparatus, and have remained in communication with land stations for considerable distances.

They are capable of ascending to heights varying between 4,000 and 6,000 ft. above sea-level, and of re-descending and journeying at lower levels, and their gas-bags are made of material which enables them to remain filled, with little leakage, for weeks at a time.

It may be taken as an axiom, therefore, that an up-to-date dirigible balloon is capable of starting in ordinary light weather from Yarmouth, and in the course of twelve hours proceeding as far as either Portsmouth, Southampton, Birmingham or York, and returning again to Yarmouth, when, having taken in fresh supplies of petrol and oil, and some thousands of cubic feet of hydrogen, and possibly a fresh crew, it can again proceed on an equally lengthy journey, throughout the whole of which it may remain at an altitude of a mile above sea-level.

A Zeppelin, under similar conditions, starting from Yarmouth, could go to and return from any point in England, or on the east coast of Ireland, or to Scotland as far north as Glasgow or Dundee.

It is a moot point whether a balloon has much to fear from electric storms. Many free balloons have been in the air without accident in severe thunderstorms, whilst I only know of one case of one being struck and set on fire, but the chances are so uncertain, that in peace time it is always advisable to quit the air should thunderstorms approach.

It is when on the ground exposed to the force of the wind, especially when this varies its direction rapidly, that a dirigible balloon is most in danger of destruction, but methods of anchoring these are improving, and it is probable that any well-designed type may be trusted to ride in safety at anchor, in winds up to 30 miles an hour, or even in strong winds if the engines can be used to assist.

A non-rigid balloon, in case of violent winds, may be rapidly deflated, without damage, except for the loss of the hydrogen it contains.

Aeroplanes.—Enough has been done to date to establish the power of an aeroplane to rise in any fairly level open space with a run of from 60 to 200 yds., and in the hands of a skilled operator to travel in fair weather a distance of over 100 miles.

That no long sensational flights, such as that from London to Manchester, have yet been accomplished, must be put down, partly to the large sums of money at the mercy of the limited number of skilled aviators for exhibition flights over small circular courses, and partly to the disinclination of aviators to risk themselves and their machines at present in a flight which must at present impose a severe strain on both them and their engines.

Developments. Dirigibles. — As regards developments, it appears probable that the largest dirigible balloons at present constructed do not represent in size the ships of the near future.

Even the Zeppelins, which equal the largest cruisers in size, cannot compare with some of those even now contemplated on the Continent, whilst with increase of size will come increase of speed and of carrying capacity, allowing of a larger radius of action, and of carrying very considerable spare weight.

That long journeys will be undertaken is certain, when scientists of such acknowledged renown as Dr. Hergesell are seriously contemplating sending an expedition to Spitzbergen, and thence to the North Pole.

These large ships will, in all probability, be of the rigid type, owing to the comparative safety of that type should accident occur to one of the numerous contained balloons, whilst with the non-rigid and semi-rigid types, should any considerable tear in the envelope occur whilst travelling at high speed, as in the case of the "Republique," the destruction of the vessel is practically assured.

I am of opinion, therefore, that vessels of the semi-rigid and non-rigid type will not tend to increase in size beyond the 250,000 to 300,000 cubic ft. vessels already under construction, whilst it is not improbable that the tendency will be to build more easily-handled vessels of from 150,000 to 200,000 cubic ft. in capacity, but on the other hand the present rigid vessels of 400,000 to 500,000 cubic ft. may be replaced by larger ones of 1,000,000 cubic ft. or more.

Aeroplanes.—The astonishing progress made with aeroplanes of various types during the last eighteen months, and the attention which is now being paid to them at home and abroad by very numerous serious engineers and scientists, and the daily developments of light internal-combustion engines, cannot but result, in the course of the next few years, in the evolution of machines which will be as far superior to existing ones as the motor car of to-day is in advance of that of 1899.

It is not probable that within so short a space of time as five or ten years they will enter into the daily life of the people as motors do now, but an aeroplane travelling at great speed and at great heights above our heads will be so common a sight as not to attract unusual attention, whilst sporting competitions in which they are engaged will not be stopped on account of weather more often than other out-of-door sporting fixtures.

Flight will probably be possible with smaller horse-power than at present; motors will be more reliable and economical of fuel; methods will be adopted for increasing or diminishing speed; automatic or almost automatic stability will be assured, whilst large numbers of men will be able to manage the machines.

With automatic stability the strain on the pilot's nerves will be reduced, and the distance a machine can travel will depend solely on the amount of petrol carried and the force of the wind with or against it.

There seems no reason why heights of 5,000 or 6,000 ft. should not be attained as easily as 1,500 ft., so considerable mountain ranges can be traversed, and it needs little imagination to assume that non-stop runs of 400 or 500 miles will probably prove not uncommon.

Military Aspect.—I pass, however, to the, for us, all-important question as to what are to be the uses in war of these machines, and on such an unknown subject I can only offer the opinions I have arrived at after several years of careful study, and I ask you to consider them, not as the ideals of an enthusiast, but as the logical conclusions of a serious student. I hope that other students here will join in the discussion later. I ask you especially to avoid belittling the probable effects on war of aerial machines.

Now the first conclusion I have arrived at is that we must take the subject very seriously; it does not suffice to blind our eyes to patent facts and to say that what has never been done never will be done, nor must we tackle it in a half-hearted manner.

Uses of Dirigible Balloons.—The first and most obvious use to be made of aerial machines is "reconnaissance."

We have in them portable observatories, capable of accompanying armies in the field, and of taking staff officers, photographers, and telegraph operators over the whole theatre of war with the speed of a railway train.

Reconnaissance is of two general types—"strategical," which necessitates travelling over very long distances in order to observe the movements of troops, trains, &c., whilst still far distant from our own forces; and "tactical," which entails obtaining detailed information as to the position and movements of troops within a comparatively small radius.

The necessity of obtaining information is so great that heavy risks are willingly run in order to secure it, whilst often strategical

information is exceedingly difficult, if not impossible, to procure, and serious fighting, leading to heavy loss, especially among our mounted troops, has often to be incurred in order to obtain "tactical" information.

It is obvious that the large dirigible balloon, of the present day even, is able, *if not interfered with*, to obtain and transmit with speed and accuracy information at great distances from its base on very many days of the year, whilst the smaller balloons are capable, under similar conditions, of doing the same service for short distances, and are especially fitted for tactical reconnaissance. It would be madness not to have such vessels with every force.

Obstacles.—The question then comes in—"what will prevent the dirigible balloon obtaining its information?"

First and foremost is weather, on which it, more than other instruments of war, is specially dependent.

Snow and heavy rain, lightning, and tempest, may hamper the movement of troops and their trains, but they may render a dirigible balloon absolutely incapable of any useful action

On the other hand, whilst all troops moving on land suffer for a long time from the effects of snow, which lies deep on the surface, and rain, which transforms roads into quagmires, and renders ordinarily harmless streams impassable, the moment fair weather comes the dirigible balloon, which has remained safe in the shelter of its house during the bad weather, or which has been packed up on its wagons and can be put together and filled in a few hours, can come out, and careless of all obstacles such as swollen rivers, broken bridges, and sodden tracks, proceed about its duties, covering in half an hour what is a laborious day's march for the army, and in a single day reconnoitring an enormous area.

Artillery Fire.—Next comes the question of the enemy's fire.

At heights as great as 5,000 ft. or 6,000 ft. the effect of infantry fire is very small on a balloon. The effect of shrapnel bullets is also small; that of a clean hit or of the base of a shell is greater, but not immediately dangerous, except in the rare case of the motor, or other important piece of the machinery being hit. A lucky burst, however, right on, or in the balloon, would prove at once disastrous.

At such great heights practically only howitzers or specially constructed guns, with high angles of elevation, could reach the balloon.

Krupp has devised a special balloon gun of ingenious construction firing a special shell, the lower part of which is filled with a smoke-producing material which enables the trajectory to be seen, whilst the nose is filled with picric acid, and furnished with a percussion fuze so sensitive as to be operated even on striking the fabric of a balloon. A hit by such a shell, which can reach to heights far greater than that at which a dirigible can operate, would at once prove fatal to it.

Chances of being Injured.—Here it is well to inquire, knowing this special danger to which a balloon is exposed, what are the chances against it?

Naval Airships.—For naval reconnaissance at sea, the balloon is never required to come within range of the enemy's ships. There is no obstacle to its view over the level sea, the objects it has to observe are large, and can be reported from a great distance, and it need run no risk of destruction from an enemy's guns.

Strategical Airships.—On land, it appears to me that the dirigible used for strategical reconnaissance runs but little danger.

It is impossible to keep batteries of artillery, or even single guns, scattered all over the country with gun crews ready and prepared for instant action, for perhaps weeks together, waiting for the possible advent of an airship, which will only present a target for a very short period of time.

Moreover, in all but very clear skies, an airship can take advantage of low-lying clouds to hide itself from view, descending below them for short periods to observe; under such conditions it is very probable that it may not be seen at all, whilst it can obtain useful information at night by descending to 1,500 ft. or 2,000 ft. or lower, when experience shows, that even when expected, and when looked for by the aid of search-lights, it is a very difficult object to discover, even on a clear night.

Even the special automobile guns, unless present in great numbers, will probably have very few opportunities of firing, roads will not always run in the proper direction to enable them to get within range of an airship when it is seen, whilst we know little as to the probable accuracy of fire of such guns at targets moving at a great pace high in the air.

Tactical Airships.—With tactical airships the circumstances are somewhat different.

Tactical reconnaissance requires to be more detailed than strategical. The numbers of troops, and their exact localities, have to be more precisely recorded, details of earthworks must be studied, and closer observation entails remaining over particular areas for more extended periods.

Moreover, with a field position, large numbers of field guns and howitzers will be distributed over a comparatively small area, and many of these will be available for instant action, whilst numbers of men will be on the look-out. The risk to an airship remaining for any length of time over the enemy's position will probably be very great.

A small and slow airship, with a very limited radius of action, will probably be unable to trust itself, except for very short periods for very special objects, within range of the enemy's guns, but even so, such ships may be of very considerable utility, as a great deal of detail can be seen from a height of 5,000 ft. even to a distance of five or six miles, and in savage warfare, where artillery need not be feared, there is no need to keep an airship at a distance.

Such ships, however, I do not advocate, as their speed is small, and in anything but light winds they would be incapable of making the desired point.

There is an aspect of the question which has also to be very seriously considered, and this is: How are the artillery to know whether an airship within range belongs to their own force or to the enemy? Unless all nations agree to use ships of entirely different design, or of different colours, which seems to be in the highest degree unlikely, it must be exceedingly difficult for a non-expert to distinguish between them.

It may, I think, therefore, be accepted that a vast amount of reconnaissance work can be done by such airships with but little risk of danger from the enemy's guns.

(To be concluded.)

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Headlamps for Dirigibles.

YET another invention which has been developed in connection with the motor car is coming to the aid of the dirigible. It is, of course, important to be able to locate the position at night, and for this good headlights are required. It is interesting to note, therefore, that the Clement-Bayard airship is to be equipped with the C.A.V. lighting system by variable speed dynamo (Leitner's). Not only will the headlights be illuminated in this way but also all the various instruments in the car of the airship.

"Collapsible" Sheds.

M. BESSONNEAU, of Angers (France), otherwise known in the world of aviators as "the originator of the collapsible shed," sends us particulars of his latest invention, the "collapsible" (canvas) shed for aeroplanes, which consists of a detachable wooden or metal framework, covered over with a special light and proofed canvas of which he is the maker.

The collapsible sheds for airships, now in use by the French and Russian Governments, were carried out at M. Bessonneau's works, where he employs some 5,000 hands for the manufacture of rope and canvas, and have been illustrated in our pages.

The advantages of having a "travelling aeroplane house," which can easily be taken to pieces and packed to a minimum volume for transport, or put up again in a very short space of time, are too obvious to need enumeration.

That they have so commended themselves to foreign Governments and others is sufficient reason for giving them serious attention in Britain.

Catalogues and Rapid Developments.

MESSRS. J. BONN AND CO., LTD., of 97, New Oxford Street, although old-established, are quite a live firm and move with the times. They have taken up aeronautical work energetically, but progress is so rapid that they find it practically impossible to keep their regular catalogue up-to-date in this respect. They inform us that they will be, therefore, at all times pleased to give the latest information upon application, and will be glad to receive suggestions from old or prospective customers, which will receive the most careful attention.

AVIATION NEWS OF THE WEEK.

Hon. C. S. Rolls at Eastchurch.

ON Saturday last the Hon. C. S. Rolls flew alone for ten minutes at Eastchurch, and afterwards flew for six miles, taking as a passenger Mr. L. R. Peterkin, a prominent New York banker, and organiser of the American Wright Co. Later in the day, in spite of the rain, he carried Mr. Alec Ogilvie, who weighs round about 12 stone, for some three or four miles.

Flying into London.

WHILE at Pau recently Mr. Grahame-White made a wager that he would fly from a point down the River Thames to within a mile of the heart of London. Mr. Grahame-White has one of his Blériot monoplanes at Brooklands, and on Thursday of last week made several short flights for the purpose of tuning up the engine of his flyer, but the wind was against making any attempt at cross-country flying at the beginning of this week. The actual starting and landing places will not be made known until just before the start, as it would obviously be undesirable to have a large crowd at either place. In order that Mr. White may fly as little as possible over houses, the route chosen will be directly over the river.

The Nationality of the Farmans.

THERE are still some people who entertain lingering doubts that the Farman Brothers cannot be really claimed as of British nationality, but such doubts should now be completely set at rest by the award of the Prix de Voyage by the Aero Club of France. This, as we announced last week, was given to M. L. Blériot, although Mr. Maurice Farman had made better performances. The latter, however, was disqualified because he was an Englishman.

Recording the "Race to Westminster."

OUR contemporary, the *Evening Standard*, is right up to date in its idea for graphically recording the progress day by day of the General Election; the rival parties, the Unionists and the Coalition, being represented each by an aeroplane in full flight, showing on the wings the number of seats secured, and steering a direct course for "Big Ben."

Activity at Issy.

PERHAPS the most noteworthy arrival at Issy last week was a new Blériot monoplane, built to the order of M. Jacques Balsan, specially with a view to speed. The angle of incidence of the wings is very small. A Gnome motor is fitted, and in a series of trials last Monday the machine proved to be very fast, although M. Balsan did not attempt any turning movements. Late at night the machine was packed up for despatch to Egypt, where it is expected to make a bold bid for the speed prizes.

On the 15th inst. M. Maurice Clement was trying the first of the "Demoiselles" to be turned out from the Clement-Bayard works. His best effort was a long jump of 500 metres. The same day M. J. de Lesseps flew several times round the parade ground on his Blériot machine.

Practice at Pau.

DURING the past week one day has been much like another, there being always several of the Blériot pupils practising on their machines. On the 15th M. Zens won the Prix Duscrepet by flying four rounds of the course in two trials. Each day M. Leblanc has tested a new machine by flying for two rounds of the ground. Comte de Vogüé has left the Blériot school for a month.

At the Wright school M. Tissandier has made many flights, and it is interesting to note the regularity with which he makes them all of about twenty minutes' duration.

The New Sommer Biplane.

ON the 15th inst. M. Roger Sommer made a flight of twelve minutes on his new biplane, during which he flew across country and over the river Meuse. This first machine has been sold to M. Viateaux, who proposes to use it in France.

Doings at Chalons.

VAN DEN BORN has been making several lengthy flights on his Henry Farman machine during the last few days, and on Saturday flew for thirty minutes. The same day a new pupil of Henry Farman, M. Effimof, made a flight of forty minutes, during which he rose to a height of thirty metres.

"Observers" at Chalons.

GENERAL JOURNE, the commanding officer at Chalons Camp, who has done so much to assist the aviators there, has now notified the Aero Club of France

"Flight" Copyright.

Mr. Claude Grahame-White bringing back his Blériot to its dock at Brooklands after some short flights last Saturday. Mr. Grahame-White is seen in front helping to pull by the chassis.

that he has arranged for certain of the military officers stationed there to act as official observers in any of the club's events which are contested at the Camp.

M. Breguet at Douai.

M. LOUIS BREGUET, who has been experimenting at the Brazelle Aerodrome at Douai with a machine he has built himself, made an attempt to win one of the L.N. prizes on Sunday. The wind was high and squally, and although M. Breguet was able to fly for 1·5 kiloms., he found it impossible to keep going for 10 kiloms. in a straight line, which is stipulated in the conditions for the prize.

Olieslagers Flies for More than an Hour.

ON the 16th, Olieslagers, on his Blériot monoplane, succeeded in placing himself among the few aviators who up to the present have flown over an hour. Before a crowd of 30,000 persons, at the Senia Ground, Oran, Algiers, he kept flying for 1h. 5m. 12⅗s. During part of this time he left the aerodrome and flew over the surrounding country, and eventually landed, after a gliding flight, in front of the grand stand.

Count Lambert to Modify his Wright Flyer.

IT will be interesting to note the result of some modifications which Count Lambert intends to make to his Wright flyer, on which he has performed so many brilliant feats. The most important of these proposed alterations consists in the fitting of a cellular tail similar to those on the Voisin and Farman machines. The modified machine will be tried at Juvisy as soon as it is ready.

An Aerodrome at Bayonne.

THE Bayonne-Biarritz Aviation Society have now fixed upon the site of their aerodrome, which will be between the Nine Valley and the Cambo Road, about 4 kiloms. from Bayonne and 6 kiloms. from Biarritz. A company, having a capital of 250,000 francs, has been formed to undertake the construction of the aerodrome and necessary buildings.

Nice Flight Meeting.

M. CAMILLE BLANC having granted the use of the racecourse at Nice, the arrangements for this meeting are now rapidly being pushed on with. The military authorities have agreed to close the shooting range during the time of the meeting, and the local authorities are doing all they can to assist. With a view to attracting the aviators to Nice, the Hotel Keepers' Syndicate have offered to put them up at the finest hotels free of charge.

An Austrian Biplane.

IN the suburbs of Vienna, two brothers, Rusjau by name, have been experimenting for some time with a biplane which has several original features. It has no elevator in front, and is propelled by a single tractor, driven by a 25-h.p. three-cylinder Anzani motor. The tail is monoplane in two parts, that at the rear serving as horizontal rudder. Lateral stability is secured by ailerons placed between the tips of the main planes, as on the Curtiss biplane.

So far the machine has left the ground twice under its own power, once for a distance of 60 metres, while on the second occasion it flew for 600 metres, rising to a height of 12 metres.

Belgian Motor Show.

ALTHOUGH the Exhibition which opened in Brussels on the 15th inst. is nominally a motor show, flying machines perhaps make up the really interesting side of the show. The most prominent exhibit of all is M. Goldschmidt's new dirigible, "Belgica II," which is suspended fully inflated from the roof, and has a platform arranged round the car, so that visitors can inspect the "engine room" and "cabin," with its equipment for wireless telegraphy, &c. Among the many aeroplanes on view were the Blériot, the Antoinettte and Hanriot monoplanes, in addition to a large number of home-built machines, one of the most interesting being the Hespel Mona with oscillating wings.

The French Aero-Technic Institute.

THE composition of the Governing Committee of the Aero-Technic Institute, founded by M. Henri Deutsche de la Meurthe, has just been confirmed by M. Liard, Rector of the Academy of Paris. The Committee will be presided over by the Vice-Rector, while the Vice-Presidents will be M. Henry Deutsche de la Meurthe and the Dean of the Faculty of Science of the Paris University, the ordinary members being MM. Leon Barthou, Bıaumès, Blériot, Commandant Bouttieaux, Cailletet, Carpentier, Commandant Estienne, Hugon, Janet, Jouguet, Kapférer, Kœnigs, Le Cornu, Loreau, Marchis, Painlevé, Picard, Sauvage, Soreau, Urbain, Gabriel Voisin, Weiss.

"Flight" Copyright.

Mr. Claude Grahame-White, who has been flying at Pau, last week, during his visit to London, made some short flights at Brooklands preparatory to any attempt at his proposed long flight from the Valley of the Thames to some central point within two miles or so of Charing Cross. Our photograph shows Mr. Grahame-White in the air on his Blériot monoplane.

German Army Officers Flying.

APART from the German officers who are being trained in the use of the Wright, there are others who are endeavouring to become proficient in the new art. Col. Ilse, an officer of the 18th Corps, is experimenting with an Euler monoplane at Frankfort-on-Maine, while Lieut. Schott is making trials on a Grade monoplane at Bork, just by Berlin.

Lilienthal Aerial Bicycle.

FROM Berlin comes the news that Herr Gustavus Lilienthal, a brother of the famous pioneer in flying matters, has just discovered a method by which a monoplane can be propelled by muscular action just as easily as an ordinary bicycle. Although no details of the invention have yet been divulged, it is said to have deeply impressed a number of aviators who have seen it.

Flyers in the Turkish Army.

IT is reported from Constantinople that the Turkish military authorities have decided to organise aviation sections in the three first army corps. A foreign officer will be appointed to take charge of this new branch of the Sultan's army.

THE LATE LEON DELAGRANGE AS A SCULPTOR. —This great pioneer in aviation had, as we stated a fortnight ago, great talent as a sculptor, which had won recognition on the Continent. His beautiful conception, "Youth and Love," reproduced above, is one of the works by which he is represented in the museum at Copenhagen.

Exhibition at Rome.

AN exhibition of flying machines and appliances connected with the art is to be held at Rome next March, under the joint auspices of the Audax Italiano, the Aviation Club, the Italian Aeronautical Society and the Association of the Press. Baron Sonnino, who has taken a leading part in furthering the cause of aviation in Italy, is honorary president of the organising committee.

St. Petersburg–Moscow Race.

THE Aero Club of Russia are considering the question of organising for the coming summer an aeroplane race from St. Petersburg to Moscow.

Model Gordon-Bennett Race.

THE large number of children who play with model aeroplanes in the Tuileries Gardens has suggested to our French contemporary *L'Auto* the idea of a Gordon-Bennett Cup for model aeroplanes, which it proposes to hold towards the end of February. It is suggested that the leading aviators should give small prizes bearing their names, as it is felt that the sentimental value attached would do a lot to stimulate interest among the rising generation.

A 70-h.p. N.E.C. Engine.

AMONG the latest orders placed for N.E.C. aeroplane engines is one from Messrs. Wyndham-Elliot for one of the six-cylinder type. This will be used on a monoplane of special make, which it is probable may be seen at Olympia. This engine will be capable of developing over 70-h.p., and so the machine should be a fast one.

POINTS TO NOTE.

British Fabric for Aeroplanes.—It is interesting to note that the monoplane on which Mr. H. G. Ferguson made the first flight in Ireland was entirely British made, the fabric being the production of the Dunlop Rubber Company. This firm have given a great deal of attention to perfecting their material, and on the Ferguson machine it has given surprising satisfaction. As no suitable shed could be found for the machine it had to stand a good deal in the way of severe winter weather, yet the fabric is as good now as when it was first fitted, says Mr. Ferguson.

MESSRS. COCHRANE AND CO. have recently published a revised edition of their catalogue, which gives particulars of the various aeroplane materials, fittings and accessories in which this firm specialise. They will be pleased to send a copy to any of our readers who apply for it.

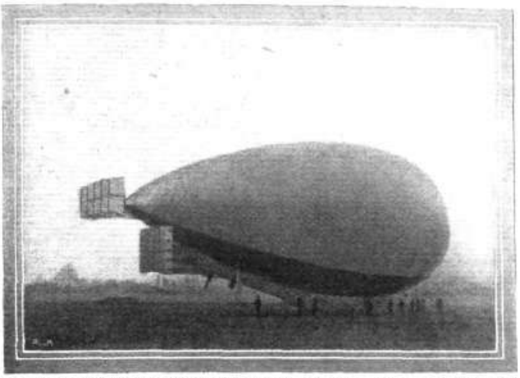
FROM Messrs. Rubery, Owen and Co. we have received one of their very fine art calendars for 1910. It is beautifully printed in colours, and adds a welcome touch of brightness to the office wall which it adorns.

MESSRS. BROWN, HUGHES AND STRACHAN, LTD., finding their premises at Acton too small for their increasing business, are now arranging for larger premises at Acton. They are now developing a department for flight work, and have an order in hand for an airship.

MESSRS. CLAUDE GRAHAME-WHITE AND CO. inform us that for the convenience of their pupils and clients they have now registered a telegraphic address at Pau, viz., "Claudigram, Pau."

THE Motor Radiator Manufacturing Co. inform us that their new Coventry works are now in full running order. They have been compelled to open up these extensive works in order to enable them to cope with the increased demand for their radiators in the Midlands and North. The London works at 23, Tanner Street, Bermondsey, London, S.E., are still being retained to deal with business located in the South, and also as a central repair depôt, but the head offices will be at Park Side, Coventry.

AIRSHIP NEWS.



THE FORLANINI DIRIGIBLE.—In the above photograph is depicted a new Italian airship, the "Leonardo da Vinci," to the performances of which we recently referred, and which, it will be noticed, has many unusual features. The airship was designed by Sig. Forlanini, who some time ago conducted a lot of research work with hydroplanes.

New British Army Dirigible.

THE new dirigible which is being constructed at the balloon factory at Farnborough is expected to be ready by the end of February. The envelope, which is being made of goldbeater's skin, will be of 72,000 cu. ft. capacity. It will be of the usual fish shape, and stability will be maintained by a system of fins. The 80–100-h.p. Green motor will drive a pair of propellers, the blades of which can be adjusted to vary the pitch.

Panhard Engine for British Dirigible.

ON the 13th inst. the second Panhard engine built for the *Morning Post* dirigible underwent its ten hours' test with complete success, running from eight o'clock in the morning to six o'clock in the evening without a hitch. The engine has four cylinders, 180 mm. bore by 200 mm. stroke. The test requires a constant power to 110-h.p. at 1,000 revs., and at the end of the trial 128-h.p. was reached. The engine ran without missing fire from start to finish, and the system of cooling was by means of the radiator and fan prepared for the balloon without the aid of any auxiliary agent.

Echo of the "Republique" Disaster.

IT is stated by the Paris *Temps* that of the £12,200 raised by public subscription after the "Republique" disaster, £1,600 will be invested for the widows of the two non-commissioned officers who were killed, while the remainder will be spent on one large dirigible, and also perhaps on a second airship and several aeroplanes. This has been rendered possible by the patriotic offers of some airship and aeroplane constructors.

£10 Airship Excursions.

THE Parseval Airship Company, which has been formed at Munich, are arranging to commence a series of airship excursions on May 1st. The voyage, for which the fare will be £10, will last for about three hours, and it is estimated that a distance of 150 kiloms. will be covered in that time. The balloon which is being built for the service will be of 6,500 cu. m. capacity, and be fitted with motors of 200-h.p.

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CORRESPONDENCE.

. *The name and address of the writer (not necessarily for publication)* MUST *in all cases accompany letters intended for insertion, or containing queries.*

Correspondents asking questions relating to articles which they have read in FLIGHT, would much facilitate our work of reference by kindly indicating the volume and page in their letters.

NOTE.—*Owing to the great mass of valuable and interesting correspondence which we receive, immediate publication is impossible, but each letter will appear practically in sequence and at the earliest possible moment.*

PAPER-BACKED SILK. Letter 281.

[302] We have been using and supplying for some time past a specially-prepared paper for model aeroplanes. It is strong and tough, and less than half the price of the fabrics usually used. It is made in two sizes, 20 by 30 and 22½ by 35½. We shall be pleased to give any information respecting same.

Coldharbour Lane, Camberwell. L. MALIN AND SON.

AREA AND WEIGHT.

[303] With regard to Mr. Kenelm Edgeumbe's letter, may I ask, does he not consider the ratio of plane area to weight lifted important to aviators?

It would seem from his view that the area does not matter much, but I would ask, would a raft be any use in attempting to break Atlantic records? It is surely the cross section that is important. The less area per horse-power, the more efficient is the camber.

Piccadilly. D. L. THORNTON.

PROPELLERS.

[304] The letter of Mr. Challenger is interesting, as throwing some light on what I think may be a source of loss of power in aeroplanes. When I first saw these machines at Juvisy, and again at Brooklands, I was struck by the small area of the screws, and I naturally concluded that these sizes had been arrived at by experiment. If one stands near a train rushing through a station, one feels a draught of air in the direction the train is running, but at Brooklands, when Paulhan was flying low, the draught of air was in the contrary direction; this was very distinct, though the aeroplane was several yards away. This back draught can only have been from the slip of the screw. I have never been close to a Wright machine when it was flying, but I should imagine that, as it has two propellers, the back draught would be very much less. If reports are true, the engine power of Paulhan's machine is double that of the Wrights; I therefore conclude that there is in the former aeroplane a great loss of power, and I think it is attributable to the small area of the screws.

Farnham. JOHN HENRY KNIGHT.

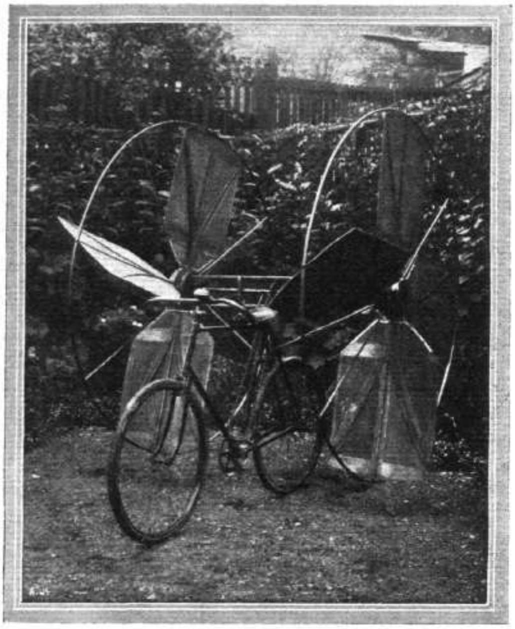
[The above letter again draws attention to the fundamental principle underlying the action of propellers, which is that the thrust of the propeller is solely and totally derived from setting in motion a column of air. Air is a fluid and consequently can only afford an abutment by virtue of its inertia to acceleration. Air in motion represents energy, and since that energy has been imparted by the propeller at the expense of the engine, the slip represents lost power. Some loss is essential, because without slip there would be no thrust; it remains for the engineer to determine the conditions of maximum efficiency. The thrust of the propeller is proportional to the cross-sectional area of the slip stream and to the square of its velocity. It would seem desirable, therefore, to reduce the velocity as much as possible by increasing the diameter of the propeller or by increasing the number of propellers. Other considerations have to be taken into account, however, such as the resistance encountered by the propeller-blades in their own passage through the air, and as these different aspects of the case are of a conflicting nature, it is a matter requiring some skill to produce the propeller that is most efficient for the work it has to do.

We would refer our readers to the several special articles on propellers that have appeared in FLIGHT; each contains at least one point of real importance to the subject.—ED.]

AN AERIAL PADDLE.

[305] Knowing the great interest taken by a great many of your readers in propellers, I venture to submit a new form of propeller I have lately protected. As you will see by the photo, it was tested by mounting a pair on a cycle and driving them from the back wheel by a chain. The machine and rider weighed 200 lbs., and could be moved from a standing position, working the propellers by manual power up to a speed of about 80 r.p.m.

As wood was used for the bearings there was considerable loss in friction, also, there is no doubt, the timing of the blades to open



and close could be improved on. I claim for this propeller a greater thrust per h.p. than the screw propeller now used; it is reasonable to suppose the efficiency of the dirigible balloon would be greatly increased if such propellers were fitted, as they run at a lower speed and would require less h.p.

I should be pleased to demonstrate them to you, or any of your readers feeling interested, by appointment.

Highgate Road. E. SIMKINS.

[The device shown in the accompanying photograph would be better described as a feathering paddle. An ordinary paddle is, of course, useless for aerial work because, being submerged in the fluid in which it acts, its propulsive effect is equal in both directions. Paddles for marine propulsion drive a boat by virtue of the difference in density between the water and the air.—ED.]

FLIGHT GOLF.

[306] I notice a letter from A. E. Jones in your current issue, forwarded to me, in reference to "Flight Golf."

I think there is the germ of quite a good idea in it, but to be practicable the only similarity to golf would be the fact that the scoring would be by the number of flights required to reach a certain spot; it would not be advisable to have more than about six "holes" or points of destination, otherwise it would take an endless time to play a game. The "holes"—or perhaps we might call them "greens"—ought to be as much in the form of a triangle as possible, so as to be the same for most changes of wind, and might be the size for average golf green.

Some form of mechanical winding would be necessary, of course, to save time, and I should think quite a small model would be better than a large one. The great difficulty would be strong winds. No doubt, given suitable weather, such a game would be very educative, as at present most of us are content to get a good flight in any direction, and do not bother to find out the best way of reaching a given spot sideways or against the wind. Two propellers are a great help to continuity of direction provided they run at the same speed, or it is easily possible by winding the leeward one a few more turns to make my own model fly straight across a wind.

Gliding over Snow.—To change the subject, up here on the snow-covered Swiss mountains, would be a most excellent place to learn gliding. There is seldom any wind, slopes in abundance of every gradient, a pair of skis fitted to the plane would form a perfect means for gaining momentum, and the landing would be soft and easy. Of course in a wind it might be difficult, as the currents must be very complicated.

Montana s. Sierre (Switzerland). FLEMING WILLIAMS.

ANTOINETTE MODEL.

[307] I, in conjunction with my brother, Mr. Walter Edward Fox, am constructing a large motor-driven Antoinette model, and would be glad if you could furnish us with a few particulars of the full size machine which are not fully explained in your description of the latter. We desire to make as near a copy of the original flyer as possible.

Query 1.—Do the main spars enter the fusellage vertically or do they tilt according to the angle of incidence?

Query 2.—Can you kindly oblige us with a sketch of the bracket which fastens the leading spar to the body of the machine, and another explaining the chassis, and whether the ash skid projecting from the front of the flyer is fixed at its top end to the narcelle or to the vertical steel tube of the landing arrangement?

Query 3.—Is the cross-piece which supports the main bracing spar composed of metal or wood?

Query 4.—What is the dihedral angle of the wings to the horizontal?

Query 5.—Are the warping wires connected to the wings at the junction of the vertical strut with the main spar or nearer the tips?

Query 6.—Is the greatest depth of the fusellage greater than the greatest width. And what are the exact measurements?

Query 7.—How far is the trailing edge of the main planes (at their greatest width) below the leading edge?

Query 8.—In what way are the rudders hinged to the tail planes?

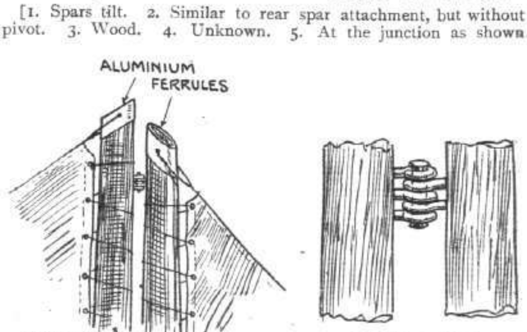
Query 9.—Is the keel of the body, at the point where the chassis joins it, composed of a single member or two, spaced a few inches apart? (This is suggested by the fact that the centre bracing strut is a continuation of the vertical hollow steel tube of the shock-absorbing contrivance.)

If possible, we intend to exhibit the machine at the forthcoming Olympia "Aero" Show next March.

Thanking the proprietors of FLIGHT for making their journal such an interesting and instructive paper.

Chiswick, W. ERNEST WARDE FOX.

[1. Spars tilt. 2. Similar to rear spar attachment, but without pivot. 3. Wood. 4. Unknown. 5. At the junction as shown



on p. 663. 6. Exact figures unknown; scale off from p. 663. 7. Unknown. 8. Hinges for both elevator and rudder formed of brass wire eyes as in accompanying sketch. 9. A wooden yoke is provided surrounding the pillar.—ED.]

FORMULÆ.

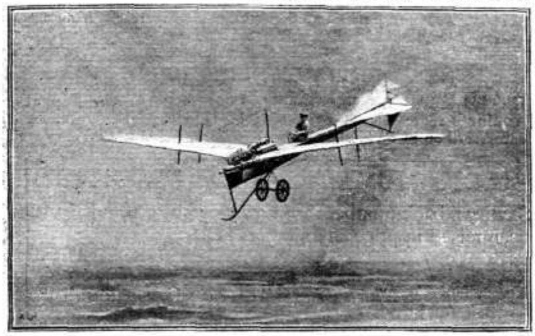
[308] In reply to letter No. 282 of Mr. J. D. Ross, some of the points he raises are dealt with fully in a book which I have in the press, and which is to be sold at a figure below 10s. I do not think there is anything quite at the low price your correspondent mentions which would give him the information. With regard to Question 3, as to ratio between surface area of the propeller blades and that of the aerofoils, it does not appear to me that any useful purpose would be served by a formula for this, as no definite relation exists. So much depends on other ruling factors, and the propeller problem in

itself is quite of sufficient difficulty without attempting to relate any one particular incidental feature in its construction to another detail of the construction of the machine. The only important relation between the propeller and the rest of the machine is its thrust value and its effective pitch. If a machine is designed to fly at any minimum speed the only consideration that need trouble Mr. Ross is that his propeller should give the required thrust to maintain that speed, and when doing so it must travel through the air at the speed of flight, *i.e.*, true pitch and slip must be known and accounted for.

London, W.C. ROBERT W. A. BREWER.

ANOTHER SCALE MODEL FROM "FLIGHT."

[309] Is this of any interest to you or your readers? Photo of model Antoinette I made from the scale drawings in Nos. 43 and 44 of FLIGHT. It is not an actual flyer at present. I have it for



show purposes in the shop window, working (the propeller) by electric motor. The scale is $\frac{2}{3}$rds inch to the foot.

Church Street, Preston. A. C. BECKETT.

THE "DEMOISELLE."

[310] I should be greatly obliged if you could assist me on the following point.

I propose making a model aeroplane, preferably "La Demoiselle," but have so far been unable to obtain drawings of the same. I see they have been in FLIGHT some time ago, so if you could let me know the required numbers I should be obliged. I find that your valuable journal is the most instructive and interesting of its kind.

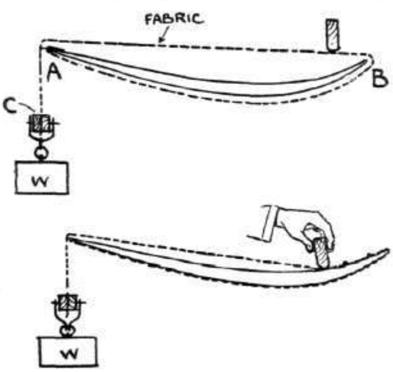
Rotherham. J. CONVILLE.

[The description of the "Demoiselle" appeared in Nos. 40 and 41.—ED.]

SURFACING.

[311] I write to suggest a method of fixing canvas or wings, &c., which may be of use to Mr. L. L. Richards.

Fasten down one edge first, either with tacks or sewing, then bring



the material under the framework round over the top to the edge which has been fastened down. The cloth must be longer than is required to cover the frame. The free end is now to be fixed between two spars of wood, C, the two pieces of wood with the end of the cloth between being fixed together with screws. To the wood hang two equal weights, equidistant, and then proceed to fasten down cloth where necessary.

If the plane be a curve proceed as follows: Fix at A first, then carry cloth under the convex side, round B, over the concave side to A, hang weights as before (or fix with springs), then, having fixed down at B, take a sufficiently strong spar of wood and press the cloth down on concave surface and nail.

Most cloth will stretch when wet, therefore it is advisable to damp the cloth before fixing it down.

Trusting this method may be of use,

London. ROBERT-BAILLIE GALT.

CONSTRUCTION OF MODEL PLANES.

[312] I much appreciate the compliment you paid me in inserting my drawing, *re* the "Construction of model planes," in the pages of FLIGHT this week.

One important detail is, however, omitted, which stood as a footnote to the drawing, viz., the screw-holes drilled in the lower whalebone strips of the ribs should be a little closer together than those in the upper strips, according to the camber required.

If this is done, a rigid and permanent camber is produced, by the tension of the lower strip. I think, perhaps, this might not be apparent from the drawing unexplained, so if you see fit will you insert this also?

Downham Market. HAROLD KELK.

DUTHEIL-CHALMERS ENGINE.

[313] I should be much obliged if you or any of your readers could give me information as to the Dutheil-Chalmers engine. Also whether it has been fitted to any and what successful aeroplanes.

Folkestone. M.

[At the time of the last Olympia Show Mr. Windham exhibited a flyer fitted with a Dutheil-Chalmers engine.—ED.]

WARPING.

[314] Would you hindly inform me, through your valuable paper, the best method of warping a pair of $11\frac{1}{2}$ ft. span wings of a monoplane, the aspect ratio being $4\frac{3}{8}$—1? How much of the wing should be warped—*i.e.*, how near the extremity should the warping-rope be attached? How much of the trailing edge is sufficient? Is it necessary for the wing that is not being warped down to rise a corresponding amount to the one that is?

Newmarket. R. R.

[What is probably the most satisfactory method of warping the wings of a monoplane is that followed in the "Antoinette" construction. The rear transverse spars of the main wings are in this machine pivoted to the chassis frame so that they can rock. One spar is raised as the other falls. The forward transverse spars are fixed rigidly, and consequently the result of tilting the rear-spars is to cause a gradual warping of the planes, which increases in amount from the shoulder to the tips.

The actual operation of warping is accomplished by means of suitable wires connected to the spars, and the operating mechanism is under the pilot's control.

In machines where the spar is not arranged to tilt, warping is accomplished by flexing the spar under the actual tension of the operating wires. In this case it is advisable that the operating wires be attached at least three-quarters of the way from the shoulder in order to secure an effective leverage. Details of warping mechanisms can be seen in the various photographs and sketches that we have already published of the principal machines.—ED.]

FARMAN SCALE MODEL.

[315] I intend to build a model of Farman's biplane, scale 1 in. to 1 ft., from drawings issued in part 42 of FLIGHT. Would you be so kind as to tell me if birch $\frac{3}{16}$ in. square would be suitable for the framework of same or would you advise a smaller size? Would you say also what sized propeller or propellers would be required to drive the same.

Battle Bridge. C. G. JAGO.

[Perhaps some of our readers who have made models about this size could give our correspondent advice on this matter.—ED.]

SPRING MOTOR.

[316] Could I find out, through your valuable paper, if I can get a suitable spring motor for a propeller 18 in. diameter, 18 in. pitch, and 3 in. face on blades, the motor to be capable of running 500 revolutions in 30 seconds, and the weight not to exceed *16 or 18 oz.*? And oblige yours faithfully,

Hayle. SPRING MOTOR.

MODEL WORKING DRAWINGS WANTED.

[317] Could you or any of your readers advise me where I could procure the working drawing of the Fleming-Williams model monoplane, also the necessary materials for building same. Trusting you will be able to oblige me.

Brighton. F. PIKE.

PROPELLERS.

[318] On p. 30 of your issue of January 8th, an interesting problem is raised by a correspondent on the relative efficiencies of 2-blade and 4-blade propellers respectively. As I have noticed in the advertisements of one of the firms a photograph of Mr. A. V. Roe making a pioneer flight with a 9-h.p. aeroplane in which a 4-blade propeller is used, I should like to ask if the 4-blade propeller is not preferable to the **2**-blade for *low* powers? I ask this because I know of no aeroplane making successful flights at such low powers as that mentioned, and in the photograph of the machine the four blades are easily visible. From this I assume that the propeller is driven at a low speed, the propellers of most other machines not being visible.

St. John's Wood Road. D. A. MACALISTER.

BOOKS WANTED.

[319] I should be very much obliged if you or any readers of your paper could recommend an inexpensive book dealing with flight problems, more especially with those concerning the curves of the planes.

Sutton, Thirsk. J. BENTLEY HANSELL.

OIL *V.* VARNISH.

[320] Many of your readers apparently have a difficulty in obtaining a dressing for linen for covering aeroplane models, but I have had considerable success with a preparation of my own that I use, and might give the following hints.

The linen may be oiled before putting on the frame, but it is better to shrink it on the frame first, and then with a brush give it one or two coats of oil; generally, one coat will be sufficient. It does not increase the weight to any appreciable extent, as a little oil goes a long way.

Varnish is unsuitable for this work, as it has a tendency to set hard; oil, on the other hand, is eminently suitable. I have put as many as three and four coats on oilskins without them becoming hard or brittle. The mixing should be governed by the purpose for which the oil is required.

For coating the linen with oil I use an ordinary black-lead brush, which, being stiff, spreads the oil very thinly; for a very fine covering, such as silk, a softer brush may be used.

The oil I use will readily take any desired colour by the addition of a little colouring, which must be mixed with a little boiled oil of the finest quality; if added in the form of powder the dressing is liable to be thick. A little of any kind of good prepared paint may be used, but it must be of the finest quality.

81, Thornton Road, Bootle. A. TAYLOR.

ELASTIC MOTORS.

[321] I often notice in your correspondence columns that your readers have trouble with elastic motors. I don't know if it has been mentioned before, but ordinary glycerine is as good as anything for a lubricant to the elastic.

Eaton Square. H. C. LAMBERT.

FRAMEWORK FOR MODELS.

[322] In answer to your correspondent, Mr. L. Mortelmans, *re* the above, I have made a number of model aeroplanes, and the materials I have obtained in various ways. The woodwork of some of my first models was obtained by purchasing an ordinary blind lath and cutting the same into strips the required thickness. More recently, I have used dowel sticks, 3 ft. long and $\frac{3}{16}$ in. thick. These may be obtained from Borst Bros., Old Street, Shoreditch, 4*d*. per dozen. My propellers are made from 3-ply, a board of which, 3 ft. by 2 ft., can be obtained from the same firm for 6*d*.

It may be of interest to your correspondent to know that some of my early models, less the motive power, elastic, did not cost me more than 2*d*. altogether. I cover my planes with wax paper (vegetable parchment), obtained from my butterman.

Very little power can be obtained with less than 20 yards of elastic.

Trusting my information will meet the requirement of Mr. Mortelmans, and be of interest to other readers of your valuable paper.

Shoreditch. J. H. WILKINS.

DIARY OF FORTHCOMING EVENTS.

British Events.

1910.	
Feb 4–5 ..	Manchester Ae. C. Model Exhibition.
Mar. 11–19	Flight Exhibition at Olympia.
July 11–17	Flight Meeting, place not fixed.
Aug. 6–13	Flight Meeting, place not fixed.

Foreign Events.

1910.	
Feb. 6–13..	Heliopolis.
April 2–10	Biarritz.
April 3–10	Cannes.
April 10–25	Nice.
May 10–16	Berlin.
May 14–22	Lyons.
May 20–30	Verona.
June 5–12	Vichy.
June 5–15	Budapest.
June 18–24	St. Petersburg.
June 26–July 10	Rheims.
July 14–24	Rheims to Brussels, cross country event.
July 24–Aug. 10	Belgium.
Aug. 25–Sept. 4	Deauville.
Sept. 8–18	Bordeaux.
Sept. 24–Oct. 3	Milan.
Oct. 18–25	America. Gordon-Bennett Balloon Race.
Oct. 25–Nov. 2	America. Gordon-Bennett Aeroplane Race.

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